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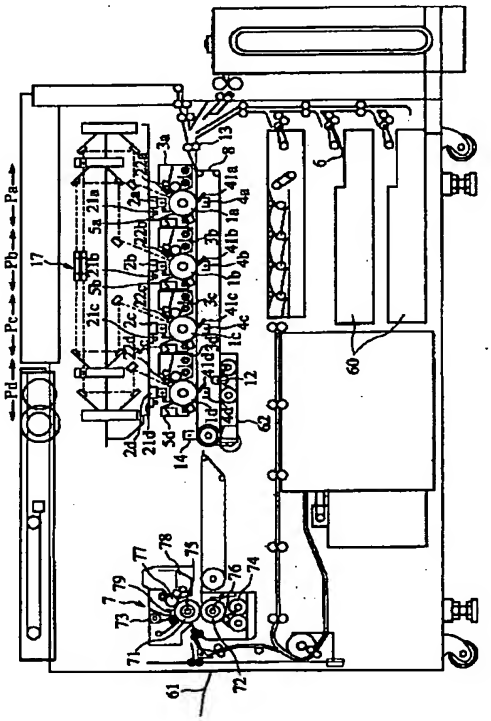
(54)【発明の名称】　画像形成装置

(57)【要約】

【目的】　複数の像担持体を有し、各像担持体は、少なくとも帯電手段、露光手段及び各像担持体毎に異なる色の現像手段を有する画像形成装置において、階調飛びのない濃度階調再現性の良い、即ち、二色以上の色を重ねて画像を得る場合の色ムラのない良好な画像を得ることのできる画像形成装置を提供する。

【構成】　複数の感光ドラム１ａ～１ｄに帯電及び露光を行なうことによって静電潜像を形成し、各感光ドラム１ａ～１ｄに形成された静電潜像を各感光ドラム１ａ～１ｄ毎に異なる色の現像剤にて現像することによって可視像となし、この可視像を記録材６に転写してフルカラー画像を得る。各感光ドラム１ａ～１ｄの静電潜像を現像する各現像剤の帯電量は略等しくされる。



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【特許請求の範囲】

【請求項１】　複数の像担持体に帯電及び露光を行なうことによって静電潜像を形成し、各像担持体に形成された静電潜像を各像担持体毎に異なる色の現像剤にて現像することによって可視像となし、この可視像を記録材に転写して画像を得る画像形成装置において、前記各像担持体の静電潜像を現像する前記各現像剤の帯電量が略等しいことを特徴とする画像形成装置。

【請求項２】　前記各現像剤の帯電量は、前記各像担持体の静電潜像を現像する現像領域で２０～４０μＣ／ｇであり、色相互間の現像剤の帯電量の差は互いに８μＣ／ｇ以内であることを特徴とする請求項１の画像形成装置。

【請求項３】　静電潜像を形成するべく前記各像担持体を露光する手段は、基本画像単位においてオフ以外の光量が複数の光を照射可能な露光手段からなり、この複数の光量によって形成された電荷潜像の電位又は現像バイアスを印加することによって現像が行われることを特徴とする請求項１又は２の画像形成装置。

【請求項４】　複数の像担持体に帯電及び露光を行なうことによって静電潜像を形成し、各像担持体に形成された静電潜像を各像担持体毎に異なる色の現像剤にて現像することによって可視像となし、この可視像を記録材に転写して画像を得る画像形成装置であって、静電潜像を形成するべく前記各像担持体を露光する手段は、基本画像単位においてオフ以外の光量が複数の光を照射可能な露光手段とされ、更に、予め用意された複数の光量レベルの中から特定の光量を選択できるようにした光量選択手段を有し、そして、予め定められた現像コントラストと、前記光量選択手段によって選択された光量とによって電荷潜像を形成し、現像を行なうようにした画像形成装置において、前記各現像剤の帯電量は、前記各像担持体の静電潜像を現像する現像領域で２０～４０μＣ／ｇであり、色相互間の現像剤の帯電量の差は互いに８μＣ／ｇ以内であることを特徴とする画像形成装置。

【請求項５】　前記光量選択手段で選択される複数の光量レベル数は前記各像担持体においてほぼ等しく、画像濃度（Ｄ）は、０≦Ｄ≦０．６の範囲で１０％以内、０．６＜Ｄ＜０．８の範囲で１４％以内、０．８≦Ｄ≦１．６の範囲で２０％であることを特徴とする請求項１の画像形成装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、一般的には、像担持体上に形成された静電潜像を現像手段にて可視像となし、この可視像を記録材上に転写して画像形成を行なう画像形成装置に関し、特に、複数の現像器を備えた多色電子写真複写装置を初め、ファクシミリやコンピュータ等の出力部を構成する記録装置等の種々のカラー複写機、カラープリンタ等に好適に具現化し得るフルカラー

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画像形成装置に関するものである。

【０００２】

【従来の技術】従来、複数の像担持体を有し、各像担持体は、少なくとも帯電手段、露光手段及び各像担持体毎に異なる色の現像手段を有し、各像担持体に形成される現像像、即ち、可視像を紙等の記録材上に転写し、これを定着することでフルカラー画像を得るフルカラー画像形成装置が提案されている。

【０００３】

【発明が解決しようとする課題】このようなフルカラー画像形成装置において、複数の像担持体上に形成された静電潜像を現像する現像手段として、例えばトナー及びキャリアを有する２成分現像剤を収容した現像器を複数個用いる場合には、各現像器の現像剤の色トナーの付着特性が異なるためにこの付着特性を各像担持体毎に補正し、略等しくすることが解決すべき重要な課題となっていた。

【０００４】しかしながら、複数の像担持体を有し、各像担持体は、少なくとも帯電手段、露光手段及び各像担持体毎に異なる色の現像手段を有する画像形成装置において、現像器内に収容した現像剤、即ち、静電潜像の現像に用いる現像剤の特性及びこの現像剤による現像像の特性と、補正手段との関係が不明確であった。

【０００５】本発明者は、多くの研究実験を行なった結果、フルカラー画像形成装置において、各現像器に収納した異なる色の現像剤の特性及びこの各現像剤により現像された現像像の特性と、補正手段との関係を明確にすることにより、階調飛びのない濃度階調再現性の良い、即ち、二色以上の色を重ねて画像を得る場合の色ムラのない良好な画像を得ることができることを見出した。

【０００６】従って、本発明の目的は、特に、複数の像担持体を有し、各像担持体は、少なくとも帯電手段、露光手段及び各像担持体毎に異なる色の現像手段を有する画像形成装置において、階調飛びのない濃度階調再現性の良い、即ち、二色以上の色を重ねて画像を得る場合の色ムラのない良好な画像を得ることのできる画像形成装置を提供することである。

【０００７】

【課題を解決するための手段】上記目的は本発明に係る画像形成装置にて達成される。要約すれば、本発明は、複数の像担持体に帯電及び露光を行なうことによって静電潜像を形成し、各像担持体に形成された静電潜像を各像担持体毎に異なる色の現像剤にて現像することによって可視像となし、この可視像を記録材に転写して画像を得る画像形成装置において、前記各像担持体の静電潜像を現像する前記各現像剤の帯電量が略等しいことを特徴とする画像形成装置である。好ましくは、前記各現像剤の帯電量は、前記各像担持体の静電潜像を現像する現像領域で２０～４０μＣ／ｇであり、色相互間の現像剤の帯電量の差は互いに８μＣ／ｇ以内である。又、静電潜

像を形成するべく前記各像担持体を露光する手段は、基本画像単位においてオフ以外の光量が複数の光を照射可能な露光手段からなり、この複数の光量によって形成された電荷潜像の電位又は現像バイアスを印加することによって現像が行われる。

【０００８】本発明の他の態様によれば、複数の像担持体に帯電及び露光を行なうことによって静電潜像を形成し、各像担持体に形成された静電潜像を各像担持体毎に異なる色の現像剤にて現像することによって可視像となし、この可視像を記録材に転写して画像を得る画像形成装置であって、静電潜像を形成するべく前記各像担持体を露光する手段は、基本画像単位においてオフ以外の光量が複数（以下「複数の光量レベル」という。）の光を照射可能な露光手段とされ、更に、予め用意された複数の光量レベルの中から特定の光量を選択できるようにした光量選択手段を有し、そして、予め定められた現像コントラストと、前記光量選択手段によって選択された光量とによって電荷潜像を形成し、現像を行なうようにした画像形成装置において、前記各現像剤の帯電量は、前記各像担持体の静電潜像を現像する現像領域で２０～４０μＣ／ｇであり、色相互間の現像剤の帯電量の差は互いに８μＣ／ｇ以内であることを特徴とする画像形成装置が提供される。ここで、好ましくは、前記光量選択手段で選択される複数の光量レベル数は前記各像担持体においてほぼ等しく、画像濃度（Ｄ）は、０≦Ｄ≦０．６の範囲で１０％以内、０．６＜Ｄ＜０．８の範囲で１４％以内、０．８≦Ｄ≦１．６の範囲で２０％とされる。

【０００９】

【発明の実施の形態】

実施例１

以下、本発明に係る画像形成装置の一実施例を図面に則して更に詳しく説明する。

【００１０】図１は、本発明の第１の実施例であるカラー電子写真記録装置の一例を示す概略構成図である。本実施例にて、カラー電子写真記録装置の装置本体内には第１、第２、第３及び第４画像形成分部Ｐａ、Ｐｂ、Ｐｃ及びＰｄが併設される。各画像形成部は同様の構成とされ、各々異なった色の可視像（トナー像）を形成する。

【００１１】更に説明すると、画像形成部Ｐａ、Ｐｂ、Ｐｃ及びＰｄは、それぞれ専用の像担持体、本実施例では電子写真感光ドラムｌａ、ｌｂ、ｌｃ及びｌｄを具備する。各画像形成部Ｐａ、Ｐｂ、Ｐｃ及びＰｄにて形成された電子写真感光ドラムｌａ、ｌｂ、ｌｃ及びｌｄ上の画像は、各画像形成部に隣接して移動する記録材担持体８上に担持し搬送される記録材６上に転写される。更に、記録材６上の画像は、定着部７にて過熱及び加圧し、定着され、記録画像がトレイ６１へと排出される。

【００１２】次に、各画像形成部における潜像形成部について説明する。感光ドラムｌａ、ｌｂ、ｌｃ、ｌｄの



外周には、除電露光ランプ２１ａ、２１ｂ、２１ｃ、２１ｄ、ドラム帯電器２ａ、２ｂ、２ｃ、２ｄ、像露光手段としてのレーザビーム露光装置１７、電位センサー２２ａ、２２ｂ、２２ｃ、２２ｄが設けられている。除電露光ランプ２１ａ、２１ｂ、２１ｃ、２１ｄにより除電された感光ドラムｌａ、ｌｂ、ｌｃ、ｌｄは、ドラム帯電器２ａ、２ｂ、２ｃ、２ｄにより一様に帯電され、次いで、レーザビーム露光装置１７により露光されることにより、感光ドラムｌａ、ｌｂ、ｌｃ、ｌｄの上には、画像信号に応じた色分解された静電潜像が形成される。本発明の画像形成装置は、像露光手段としては、上述のレーザビーム露光装置１７の他に、ＬＥＤアレー露光装置などのように、基本画像単位（画素）においてオフ以外の光量レベルが複数の光を照射可能な、所謂当業界では周知の多値露光手段を好適に採用し得る。

【００１３】前記感光ドラム上の静電潜像は、現像手段にて現像され可視像とされる。つまり、現像手段は、それぞれシアン色、マゼンタ色、イエロー色、ブラック色の現像剤、例えばトナーとキャリアを有した２成分現像剤が所定量充填された現像器３ａ、３ｂ、３ｃ、３ｄを備えており、上記感光ドラムｌａ、ｌｂ、ｌｃ、ｌｄに形成された静電潜像を現像し、可視画像（トナー像）とする。

【００１４】次に、転写部について説明する。記録材カセット６０中に保持された記録材６は、レジストローラ１３を経て記録材担持体８へと送給される。

【００１５】ここで、記録材担持体８は、ポリエチレンテレフタレート樹脂フィルムシート（ＰＥＴシート）、ポリフッ化ビニリデン樹脂フィルムシート、又は、ポリウレタン樹脂フィルムシートなどの誘電体樹脂製のフィルムであり、その両端部を互いに重ね合わせて接合し、エンドレス形状にしたものか、又は、継ぎ目を有しない（シームレス）ベルトが用いられる。継ぎ目を有するベルトの場合には、継ぎ目位置を検知する手段（図示せず）を設け、継ぎ目上で転写が行なわれないように構成するのが好ましい。

【００１６】この記録材担持体８が回転し始めると、記録材６がレジストローラ１３から記録材担持体８上へと搬送される。このとき画像書き出し信号がＯＮとなり、あるタイミングにより第１感光ドラムｌａ上に画像形成を行う。

【００１７】第１感光ドラムｌａの下方には、転写帯電器４ａ及び転写押圧部材４１ａが設けてあり、転写押圧部材４１ａにて感光ドラムの方へと均一な押力を付与し、且つ、転写帯電器４ａが電界を付与することにより感光ドラムｌａ上のトナー像がを記録材６上へと転写される。このとき、記録材６は、記録材担持体８上に静電吸着力で保持され、第２画像形成部Ｐｂへと記録材６は搬送され、転写が行なわれる。以下、上記と同様な方法により第３、第４画像形成部Ｐｃ、Ｐｄによってトナー

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像が転写された記録材６は、分離帯電器１４によって除電され、静電吸着力の減衰によって記録材担持体８から離脱し、定着部７へと搬送される。

【００１８】定着部７は、定着ローラ７１、加圧ローラ７２、ローラ７１、７２をそれぞれクリーニングする耐熱性クリーニング部材７３、７４、各ローラ７１、７２を加熱するヒータ７５、７６、ジメチルシリコンなどの離型剤オイルを定着ローラ７１に塗布するオイル塗布ローラ７７、そのオイルを供給するためのオイル溜め７８、定着温度制御用のサーミスタ７９から構成されている。

【００１９】転写後、感光ドラム１ａ、１ｂ、１ｃ、１ｄ上に残留した現像剤は、感光体クリーニング部５ａ、５ｂ、５ｃ、５ｄにより除去され、引き続き行われる次の潜像形成に備えられる。又、記録剤担持体８上に残留した現像剤は、ベルト除電器１２によって除電され静電吸着力を取り除かれた後、本実施例では不織布を備えたクリーニング装置６２にて除去される。クリーニング装置６２としては回転するファーブラシとか、ブレードとか、これらを併用した装置等も用いられる。

【００２０】次に、本発明の画像形成装置に採用し得る現像手段について、図２を参照して更に詳しく説明する。画像形成部Ｐａ、Ｐｂ、Ｐｃ、Ｐｄにおける現像手段は同様の構成とされるので、画像形成部Ｐａにおける現像手段についてのみ説明する。

【００２１】図２は、画像形成部Ｐａにおける現像手段の略断面図である。感光ドラム１ａに対向して配置された現像器３ａは、２成分現像剤を収容した現像容器３０、現像剤担持体としての現像スリーブ３１、該現像スリーブ３１によって現像剤の供給位置から穂切り位置まで搬送される現像剤を規制する現像剤返し部材（現像スリーブ３１上の現像剤溜り量規制部材）３２、現像剤の穂立ち高さ（層厚）規制部材としてのブレード３３を具備し、更に、２成分現像剤の現像剤濃度（トナー濃度）を検知する現像剤濃度検知手段としての光学式の現像剤濃度センサー（図示せず）を有している。

【００２２】上記現像剤容器３０の内部は、ほぼ垂直方向に延在する隔壁３７によって現像室３０Ａと撹拌室３０Ｂとに区画されている。現像室３０Ａ及び撹拌室３０Ｂには非磁性トナーと磁性キャリアを含む２成分現像剤が収容されている。隔壁３７の上方部は解放されており、現像室３０Ａで余分となった２成分現像剤が撹拌室３０Ｂ側に回収される。上記現像室３０Ａ及び撹拌室３０Ｂにはそれぞれスクリュータイプの第１及び第２の現像剤撹拌・搬送手段３４、３５が配置されている。第１の撹拌・搬送手段３４は、現像室３０Ａ内の現像剤を撹拌搬送し、また、第２の撹拌・搬送手段３５は、現像剤濃度制御装置の制御のもとでトナー補給槽（図示せず）からこの撹拌・搬送手段３５の上流側に供給されるトナーと既に撹拌室３０Ｂ内にある現像剤とを撹拌搬送し、

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トナー濃度を均一化する。隔壁３７には手前側と奥側の端部において現像室３０Ａと撹拌室３０Ｂとを相互に連通させる現像剤通路（図示せず）が形成されており、上記撹拌・搬送手段の搬送力により、現像によってトナーが消費されてトナー濃度の低下した現像室３０Ａ内の現像剤が一方の通路から現像室３０Ａ内へ移動するように構成されている。

【００２３】上記現像器の現像室３０Ａは、感光ドラム３ａに対面した現像領域に相当する位置が開口しており、この開口部に一部露出するようにして前記現像スリーブ３１が回転可能に配置されている。現像スリーブ３１は非磁性材料で構成され、現像動作時には図時矢印方向に回転し、その内部には、磁界発生手段であるマグネット３６が固定されている。

【００２４】上記撹拌・搬送手段によって現像スリーブ３１の表面に供給された２成分現像剤は、マグネット３６の磁力によって現像スリーブ３１の表面に磁気ブラシの状態で保持され、現像スリーブ３１の回転に伴って感光ドラム１ａと対向する現像領域に搬送されるが、搬送途上で現像剤返し部材３２及びブレード３３によって現像剤スリーブ３１上の磁気ブラシは穂切りされ、現像領域に搬送される現像剤は適正な量に維持される。

【００２５】このようにして現像スリーブ３１にて現像領域に搬送された現像剤は、感光ドラム３ａに供給されてその上に形成された静電潜像を現像する。現像効率、即ち、潜像へのトナー付与率を向上させるために、現像スリーブ３１には電源から直流電圧と交番電圧を重畳した現像バイアス、或はいずれか一方の現像バイアス電圧が印加され、これによって現像領域に形成された直流電界と交番電界の重畳電界の作用により、或はいずれか一方の電界の作用により、２成分現像剤のトナーが感光ドラム１ａ上の静電潜像側に移行して該静電潜像がトナー像として顕像化される。

【００２６】本実施例で用いた非磁性トナーは、ポリエステル樹脂８０～９０重量％に着色含量を５～２０重量％と、更に負電荷制御剤としてアルキル置換サリチル酸の金属錯体を分散させた平均粒径５～１１μｍのトナーであり、これに酸化チタン（$TiO_2$）を０．２～２重量％外添して使用した。外添剤にはこの他に、シリカを用いてもよい。又、磁性キャリアは、任意のフェライトキャリア、特に焼結フェライト粒子が使用される。つまり、コア材としてＺｎ系フェライト、Ｎｉ系フェライト、Ｃｕ系フェライト、Ｍｎ－Ｍｇ系フェライト、Ｃｕ－Ｚｎ系フェライト、Ｎｉ－Ｚｎ系フェライト等を用い、これに摩擦帯電性、環境安定性、耐久性向上を目的としてアクリル系樹脂を０．５～２重量％、コートした平均粒径３０～６０μｍのキャリアを用いた。コート剤としては、この他に、ポリエステル系樹脂、フッ素系樹脂、シリコン系樹脂等を適宜選択して用いることができる。

【００２７】図３は、上記トナーとしてイエロー、マゼンタ、シアン、ブラックを用意し、これに上記磁性キャリアを混合して２成分現像剤を調製し、現像器に充填して、現像バイアスを用いて現像を行った時の、現像特性のひとつである現像コントラスト電位（かぶり保証電位）（Ｖ）と現像濃度（Ｄ）との関係を示すＶ－Ｄ線図である。理想の現像特性ａに対するマゼンタ色現像剤の現像特性を曲線ｂで示す。更に、別のマゼンタ色現像剤の現像特性を曲線ｃで示す。

【００２８】本発明の主旨は、使用する各現像器に収容した全ての色現像剤が理想特性に近いａであるようにすることであるが、説明を分かりやすくするために、同一のマゼンタ色で現像剤の現像特性の異なるものを用いて説明する。現像特性ｂが得られた現像剤条件を整理すると以下の通りである。

【００２９】ポリエステル樹脂９０重量％ベースにマゼンタ顔料（C.I Pigment Red 6）１８．５重量％、負電荷制御剤を０．５重量％混合したものを用い、酸化チタンの外添量を１．０重量％とした。キャリアとしては焼結フェライト粒子にアクリル系樹脂を０．５重量％と、２．５重量％との２種類のコート量を持ったものを用意した。

【００３０】このように調製した現像剤を前述の現像器に用い、以下の条件で画像形成を行った。感光ドラム表面の移動速度（Ｖｐ）は１３５ｍｍ／ｓｅｃ、現像は反転現像方式を用い、感光ドラム電位はダーク電位Ｖｄ＝－５００（ｖ）、ライト電位Ｖｌ＝－１００（ｖ）、現像バイアスのＤＣ成分Ｖｄｃ＝－４００（Ｖ）とした。反転現像方式においては現像コントラストを以下のように定義する。即ち、

（現像コントラスト）＝（ライト電位）－（現像バイアスＤＣ）

である。又、図３に示すカブリ電位は、

（カブリ電位）＝（ダーク電位）－（現像バイアスＤＣ）

である。

【００３１】本実施例で、現像コントラストは３００（Ｖ）となる。

【００３２】現像バイアスは、図４に示すような波形を用い、バイアスのＡＣ成分はＶｐｐ＝２（ｋＶ）、周波数はＡＣ部分の周波数１２（ｋＨｚ）、２周波の繰り返し周波数は１．５（ｋＨｚ）である。

【００３３】現像装置の条件は、現像スリーブ周面速度が感光ドラム周面速度の１．７倍で、現像領域において、図２に示すように、感光ドラムと同一方向に回転するようにしている。又、前述した現像剤の現像領域での量は４０ｍｇ／ｃｍ$^2$ になるよう現像剤返し部材３２及びブレード３３を調節した。

【００３４】さて、前述の現像特性（現像コントラスト対画像濃度）ｂは、キャリアとして焼結フェライト粒子



にアクリル系樹脂を０．５重量％と２．５重量％との２種類のコート量を持ったものを用意したが、このうちのアクリル系樹脂コート量が２．５重量％の場合であった。一方、現像特性ｃはアクリル系樹脂コート量が０．５重量％のものであった。

【００３５】このような現像特性の差が何であるかについて究明したところ、現像領域での現像剤の平均帯電量（以下「平均トリボ」という。）に大きな差があることに起因していることが分かった。現像特性ｂを示す現像剤の前記平均トリボは３０μＣ／ｇ、現像特性ｃを示す現像剤の前記平均トリボは２０μＣ／ｇであった。

【００３６】この平均トリボは、ブローメッシュ法によって測定した。次に、ブローメッシュ法について説明する。

【００３７】図５の形状の容器は、アースされた外装容器１０１と、エレクトロメータ１０２に接続されそして外容器１０１とは絶縁された内容器１０３とからなり、更に内容器１０３内には、キャリア粒経の粒子は通さずトナー粒経の粒子は通過させるように選択されたメッシュ１０４が配置される。内容器１０３内に現像剤が投入される。又、内容器１０３は吸引装置に接続されている。平均トリボを求めるには、予め重さを測定された現像剤を内容器１０３に投入しこの時の電荷量をエレクトロメータで測定する。測定した電荷量をｃ１、重量をｍ１とする。次に、吸引装置でトナーのみを吸引し、この時の電荷量をやはりエレクトロメータで測定する。この時の電荷量をｃ２とする。この後、残ったキャリアの重さを測定し、これをｍ２として以下の計算で求める。

（平均トリボ）＝（ｃ１－ｃ２）／（ｍ１－ｍ２）

【００３８】ここで、現像特性としては図中ａに近いものの方が良いことを示唆したが、特性ｂでは実際に実用に供さないというわけではない。以下、この判断がどのようにされることが適切かを説明する。この説明のために、予め本実施例に適応する階調画像を得る画像信号処理回路について説明する。

【００３９】図６にて、原稿の光像が結合レンズ２０１によってＣＣＤ素子２０２に照射され、このＣＣＤ素子２０２にて輝度信号に変換される。輝度信号はＡ／Ｄ変換回路にてデジタルの輝度信号に変換される。汎用的に用いられるＡ／Ｄ変換のデジタル信号は８ｂｉｔ（２５６レベル）であり、読み取られた原稿の輝度信号は２５６レベルのデジタル信号に変換される。

【００４０】得られた輝度信号は、個々のＣＣＤ素子２０２の感度バラツキがシェーディング回路２０４により修正される。輝度は、濃度がＬＯＧ（輝度信号）と比例関係にあることを利用して、濃度に変換される。即ち、修正された輝度信号は、ＬＯＧ変換回路を通して濃度信号に変換される。濃度信号は、この後マスキング、ＵＣＲ（下色処理）回路（以下「画像処理回路」という。）２０５で色処理された後各像担持体に付随する露光装置

１７により感光ドラムｌａ、ｌｂ、ｌｃ、ｌｄを露光する。

【００４１】露光装置１７は、露光手段として例えば半導体レーザーを用い、前述した８ｂｉｔ（２５６レベル）の画像濃度信号を光量又は点灯時間として分解露光できる回路を備えている。上述したように、露光装置１７としてはこれに限定されるものではなく、基本画像単位においてオフ以外の光量レベルが複数の光を照射可能な任意の多値露光手段を使用することができる。

【００４２】ここで、本発明に係るにルックアップテーブル（以下「ＬＵＴ」という。）２０６について説明する。ＬＵＴ２０６は、前述した画像の濃度信号を像担持体部で濃度に忠実な形で再現するために用意されるものである。先に得られた現像特性ｂを用いてＬＵＴを作成し、このことを説明する。

【００４３】ＬＵＴ２０６は、予め用意された光量レベルの中から特定の光量を選択できるようにした光量選択手段を構成するものであって、画像処理回路２０５からの濃度信号Ｘレベル（０～２５６レベルのいずれか）を別のレベルＹに変換する機能を有する。例えば、入力信号と同一レベルで出力するように設定すると、先に図３に示す現像特性ｂは、入力信号対画像濃度に書き直すと図７（Ａ）、（Ｂ）のようになり、再現画像濃度入力信号（濃度に比例）となってしまう。つまり、図中、入力信号$X_0$が$Y_0$になる。現像特性がａであればこのＬＵＴは必要ないことが理解される。

【００４４】そこで現像特性ｂの場合に再現画像の特性を現像特性ａの場合のようにするために、図７（Ａ）に示すように、縦軸に表されている濃度の最大値をもともと８ｂｉｔ（２５６レベル）に分解されているとして２５６レベルで規格化する。このようにしてできた入力レベル対規格化された出力画像レベルの関係を図中直線ｋに対して対称に移動した特性ｈｂを用意する。この特性ｈｂを、図７（Ｂ）（センシトメトリ）の第４象限に示すようにＬＵＴの中に入れ、入力信号を特性ｈｂに関係させて出力し現像する。図７（Ｂ）にて、入力信号$X_0$は出力信号$Y_1$になること、即ち、図７（Ｂ）の第２象限に示す再現画像の濃度は現像特性ａに基づいたものとなることが理解されるであろう。

【００４５】ところで、このようにＬＵＴを用いると画像処理回路からの信号を濃度に関し忠実に再現する様に見えるが、実際は更に注意を要し、この部分が本発明の要部となる。このことを現像特性ｃを用いて、前述した現像特性ｂの場合と同じ様にＬＵＴを作成し説明する。

【００４６】現像の最大濃度は現像コントラストで調整するので、図３からも分かるように、現像コントラストは2.50（Ｖ）とした。図８（Ｂ）のセンシトメトリでも分かるように、この場合においても画像処理回路からの濃度に比例した画像信号を忠実に再現していることが分かる。

【００４７】ところが、現像特性がｃで別な色、例えばシアンのトナーを用意しこれを現像し本発明に適応できる前述の画像形成装置で実際に画像形成を行うと、マゼンタとシアンの混合色であるブルーに色のとびが発生する。これはＬＵＴにおける信号の欠落によるものである。

【００４８】実際、図８の特性ｈｃと図７の特性ｈｂとにて、画像処理回路からの信号の欠落比率を調べたところ２５６の信号の内３０％以上あることが判明した。このことをより詳細に調べると、人の目視での濃度階調分解能の関係もあって濃度領域により欠落比率が異なっても分からない比率が存在することが判明した。

【００４９】異なる色間でのＬＵＴにおける信号の欠落が人の目にわからない程度としては、画像濃度を（Ｄ）とすると、０．０≦Ｄ≦０．６の範囲で１０％以内、０．６＜Ｄ＜０．８の範囲で１４％以内、０．８≦Ｄ≦１．６の範囲で２０％であることをが判明した。更に付記すると、単色レベルでのＬＵＴにおける信号の欠落が人の目にわからない程度としては色相互間の欠落量より余裕があり、０．０≦ＤＤ０．６の範囲で１５％以内、０．６＜Ｄ＜０．８の範囲で２０％以内、０．８≦Ｄ≦１．６の範囲で３０％程度であることが分かった。

【００５０】このように複数の像担持体を有する画像形成装置では各像担持体において濃度階調性を保証するために用いるＬＵＴにおいて色相互の信号欠落量を考慮した設計が必要であることが分かった。

【００５１】それでは実際に画像形成装置を設計する際にどのようにするとこの条件を満足することができるかという点について説明する。

【００５２】以上同色（マゼンタ）の現像剤を用いて説明してきたが、これを本発明に適応可能な複数の像担持体を有する画像形成装置においては、色としてイエロー、マゼンタ、シアン、ブラックの４色を用いるため相互の関係はより厳密に決定されなければならない。

【００５３】もともとＬＵＴの使用目的は、現像における理想的な現像特性ａが達成できないための補正手段であることから前記ＬＵＴにおける信号の欠落比率を一定の範囲内に納めるためには現像特性に注目する必要がある。現像の最大濃度は各像担持体の現像コントラスト設定で自由に選択できることは前述した通りである。又、現像特性の違いは、主に現像領域における現像剤の平均トリボに関係することも既に説明した。更に、この平均トリボに関して、前述のＬＵＴにおける信号の欠落にもかかわらず濃度階調再現において階調とびが発生しない条件を捜すと以下の関係があることが分かった。

【００５４】即ち、階調とびが発生しない条件は、現像剤の平均トリボの差は、現像領域での現像剤で２０～４５μＣ／ｇであり、色相互間の現像剤の平均トリボは互いに８μＣ／ｇ以内であることが分かった。これは、ある色の現像剤の平均トリボが２０μＣ／ｇである時、そ

の時のほかの色の現像剤における最大の平均トリボが２８μＣ／ｇ以内であるということである。平均トリボの最大値は、本発明のその他の制約である、例えば多重転写が安定に行われる範囲として規定される。

【００５５】

【発明の効果】以上説明したように、本発明の画像形成装置は、複数の像担持体に静電潜像を形成し、各像担持体に形成された静電潜像を各像担持体毎に異なる色の現像剤にて可視像となし、この可視像を記録材に転写して画像を得る画像形成装置において、前記各像担持体の静電潜像を現像する前記各現像剤の帯電量が略等しくされるので、階調飛びのない濃度階調再現性の良い、即ち、二色以上の色を重ねて画像を得る場合の色ムラのない良好な画像を得ることができる。

【００５６】又、特に、本発明の画像形成装置は、静電潜像を形成するべく前記各像担持体を露光する手段は、基本画像単位においてオフ以外の光量レベルが複数の光を照射可能な露光手段とされ、更に、予め用意された光量レベルの中から特定の光量を選択できるようにした光量選択手段を有し、そして、予め定められた現像コントラストと、前記光量選択手段によって選択された光量とによって電荷潜像を形成し、現像を行なうようにし、更に、前記各現像剤の帯電量は、前記各像担持体の静電潜像を現像する現像領域で２０～４０μＣ／ｇであり、色相互間の現像剤の帯電量の差は互いに８μＣ／ｇ以内となるように構成することによって、階調飛びのない濃度階調再現性の良い、即ち、二色以上の色を重ねて画像を



得る場合の色ムラのない良好な画像を得ることができる。

【図面の簡単な説明】

【図１】本発明の画像形成装置の一実施例を示す概略構成図である。

【図２】図１の画像形成装置における現像手段の一実施例の断面図である。

【図３】平均トリボの異なる現像剤の現像特性を示す図である。

【図４】現像バイアスは系を示す図である。

【図５】平均トリボの測定装置の説明図である。

【図６】ＣＣＤからの画像信号処理を示すブロック図である。

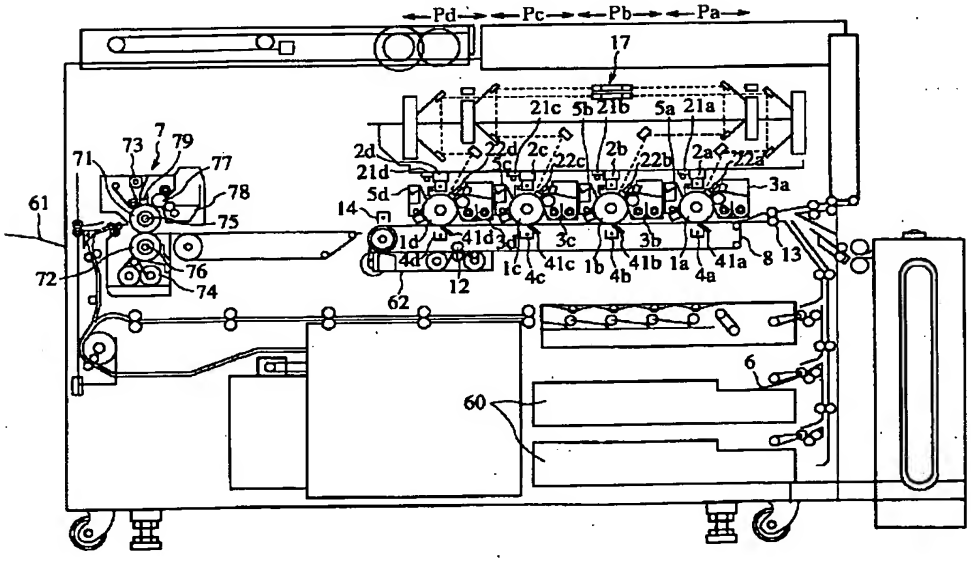
【図７】本発明の画像形成装置にてＬＵＴを使用した画像形成作動原理を説明するセンシトメトリーの一例を示す。

【図８】本発明の画像形成装置にてＬＵＴを使用した画像形成作動原理を説明するセンシトメトリーの他の例を示す。

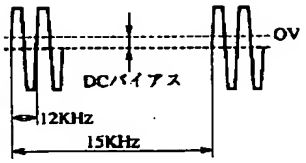
【符号の説明】

| | |
|---|---|
| １ａ～１ｄ | 像担持体（感光ドラム） |
| ２ａ～２ｄ | 帯電手段 |
| ３ａ～３ｄ | 現像手段 |
| ４ａ～４ｄ | 転写帯電器 |
| ６ | 記録材 |
| １７ | 露光手段 |

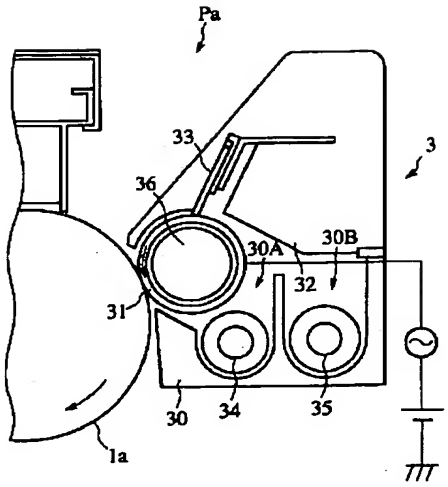
【図１】



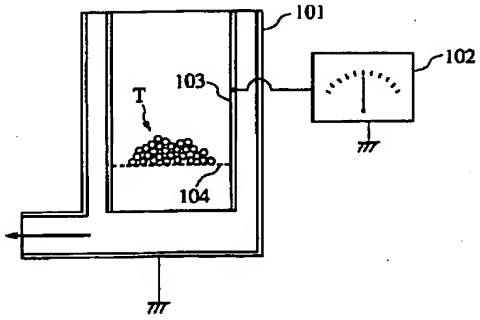

【図４】



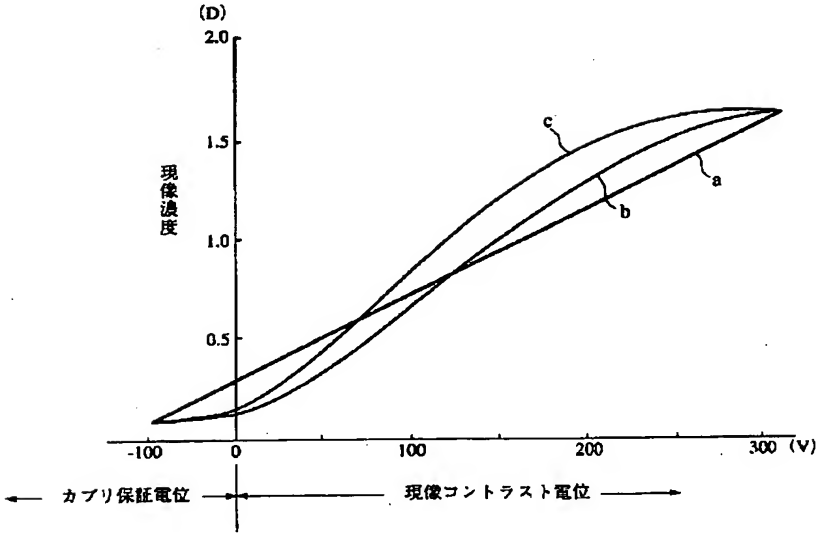
【図２】


Pa
33
3
36
30B
30A
32
31
30
34
35
1a

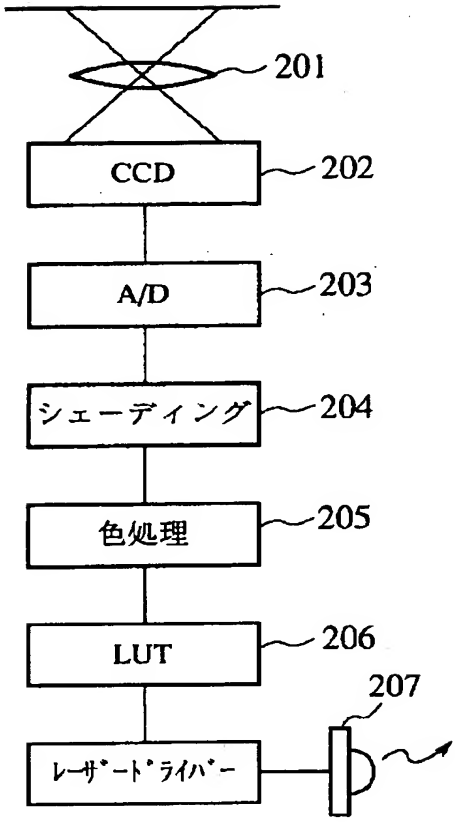
【図５】


101
102
103
T
104

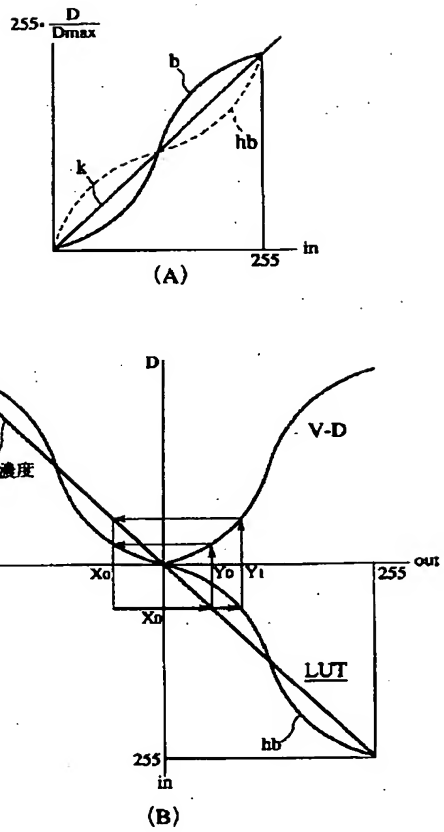
【図３】


(D)
2.0
1.5
1.0
0.5
現像濃度
c
a
b
-100
0
100
200
300 (V)
← カブリ保証電位
現像コントラスト電位 →

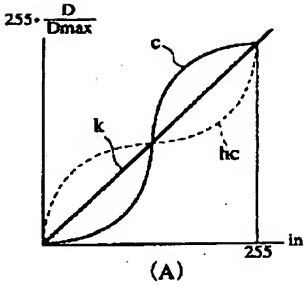
【図６】


201
CCD
202
A/D
203
シェーディング
204
色処理
205
LUT
206
207
ﾚｰｻﾞｰﾄﾞﾗｲﾊﾞｰ

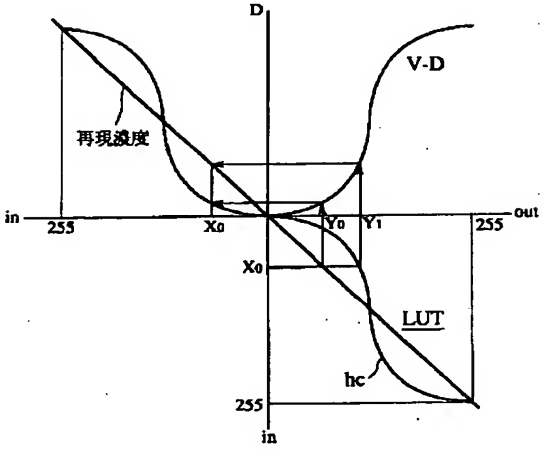
【図７】


255·D/Dmax
h
hb
k
in
255
(A)
D
V-D
再現濃度
in
255
Xo
Yo
Y1
255
out
Xn
LUT
hb
255
in
(B)

【図８】


255・D/Dmax
c
k
hc
255
in

(A)


D
V-D
再現濃度
in
255
X0
Y0
Y1
255
out
X0
LUT
hc
255
in

(B)

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(22)Date of filing : 20.07.1995

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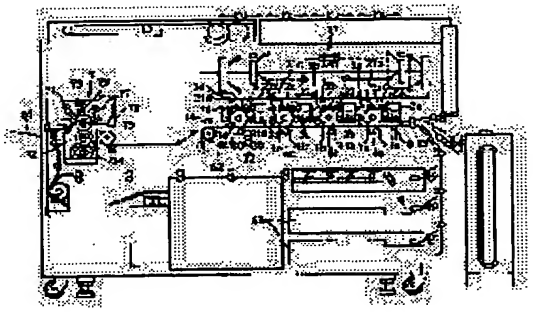
(72)Inventor : AMAMIYA KOJI

## (54) IMAGE FORMING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an image forming device by which a satisfactory image having satisfactory density gradation reproducibility free of gradation omission, that is, free of color irregularities in the formation of an image by the superimposition of two or more colors, in an image forming device equipped with a plurality of image carriers, each of which is provided with at least an electrifying means, an exposure means, and a developing means containing a different color for the corresponding image carrier.
SOLUTION: Electrostatic latent images are formed by subjecting the photoreceptive drums 1a-1d to electrification and exposure, visible images are obtained by developing the electrostatic latent images, formed on the photoreceptive drums 1a-1d, with developers whose colors are different from each other according to the photoreceptive drums 1a-1d, and a full-color image is obtained by transferring the visible images to a recording material 6. Amounts of the electrification of the developers with which the electrostatic latent images on the photoreceptive drums 1a-1d are developed are almost the same.



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* NOTICES *



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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

## CLAIMS

[Claim(s)]
[Claim 1] An electrostatic latent image is formed by performing electrification and exposure to two or more image support. In the image formation equipment which imprints a visible image, and nothing and this visible image to record material, and obtains an image by developing the electrostatic latent image formed in each image support with the developer of a different color for every image support Image formation equipment which the amount of electrifications of each of said developer which develops the electrostatic latent image of each of said image support is in abbreviation etc. by carrying out, and is characterized by things.
[Claim 2] It is image formation equipment of claim 1 characterized by for the amount of electrifications of each of said developer being 20-40microC/g in the development field which develops the electrostatic latent image of each of said image support, and the difference of the amount of electrifications of the developer between colors being less than 8microC/g mutually.
[Claim 3] a means to expose said each image support in order to form an electrostatic latent image be claim 1 or the image formation equipment of 2 characterize by perform development by impress the potential or development bias of a latent charge image which the quantity of lights other than OFF consisted of an exposure means which can irradiate two or more light in the basic image unit , and be formed of two or more of these quantity of lights .
[Claim 4] An electrostatic latent image is formed by performing electrification and exposure to two or more image support. By developing the electrostatic latent image formed in each image support with the developer of a different color for every image support, a visible image and nothing, A means to be image formation equipment which imprints this visible image to record material, and obtains an image, and to expose said each image support in order to form an electrostatic latent image In a basic image unit, consider as an exposure means by which the quantity of lights other than OFF can irradiate two or more light, and it has the quantity of light selection means which enabled it to choose the specific quantity of light out of two or more quantity of light level prepared further beforehand. In the image formation equipment which was made to develop negatives with the development contrast defined beforehand and the quantity of light chosen by said quantity of light selection means by forming a latent charge image It is image formation equipment which the amount of electrifications of each of said developer is 20-40microC/g in the development field which develops the electrostatic latent image of each of said image support, and is characterized by the difference of the amount of electrifications of the developer between colors being less than 8microC/g mutually.
[Claim 5] It is image formation equipment of claim 1 characterized by two or more numbers of quantity of light level chosen with said quantity of light selection means being almost equal in said each image support, and image concentration (D) being 20% in the range of 0<=D<=0.6 less than 14% and in 0.8<=D<=1.6 less than 10% and in 0.6< D<0.8.

[Translation done.]

* NOTICES *



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3.In the drawings, any words are not translated.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Generally this invention relates to the full color image-formation equipment which can embody the multicolor electrophotography reproducing unit especially equipped with two or more development counters suitable for various color copying machines, such as a recording device which constitutes the output sections, such as facsimile and a computer, at first, a color printer, etc. about the image-formation equipment which imprints a visible image, and nothing and this visible image for the electrostatic latent image formed on image support on record material with a development means, and performs image formation.
[0002]
[Description of the Prior Art] Conventionally, it has two or more image support, and each image support has the development means of a different color at least for every electrification means, exposure means, and image support, the developed image formed in each image support, i.e., a visible image, is imprinted on record material, such as paper, and the full color image formation equipment which obtains a full color image by this being established is proposed.
[0003]
[Problem(s) to be Solved by the Invention] As a development means to develop the electrostatic latent image formed on two or more image support in such full color image formation equipment, when two or more development counters which held 2 component developer which has a toner and a carrier were used, since the attachment characteristics of the color toner of the developer of each development counter differed, these attachment characteristics were amended for every image support, and it had become the important technical problem which the thing which spread abbreviation etc., and to do should solve.
[0004] However, it had two or more image support, and each image support had the property of the developer held in the development counter, i.e., the developer used for the development of an electrostatic latent image, and the property of the developed image by this developer, and indefinite relation with an amendment means in the image formation equipment which has the development means of a different color at least for every electrification means, exposure means, and image support.
[0005] this invention person sets to full color image formation equipment, as a result of conducting many research experiments. By clarifying the property of the developed image developed by the property of a developer and each of this developer of a different color contained to each development counter, and relation with an amendment means It found out that the good image which whose concentration tone reproduction without a gradation jump is good, namely, does not have the color nonuniformity in the case of obtaining an image in piles in the color more than a two color could be obtained.
[0006] Therefore, in the image formation equipment which the purpose of this invention has two or more image support especially, and has a development means of a color by which each image support differs for every electrification means, exposure means, and image support at least, it is offering the image formation equipment which can obtain the good image which whose concentration tone reproduction without a gradation jump is good, namely, does not have the color nonuniformity in the case of obtaining an image in piles in the color more than a two color.
[0007]
[Means for Solving the Problem] The above-mentioned purpose is attained by the image formation equipment concerning this invention. If it summarizes, this invention will form an electrostatic latent image by performing electrification and exposure to two or more image support. In the image formation equipment which imprints a visible image, and nothing and this visible image to record material, and obtains an image by developing the

electrostatic latent image formed in each image support with the developer of a different color for every image support It is image formation equipment which the amount of electrifications of each of said developer which develops the electrostatic latent image of each of said image support is in abbreviation etc. by carrying out, and is characterized by things. Preferably, the amount of electrifications of each of said developer is 20-40microC/g in the development field which develops the electrostatic latent image of each of said image support, and the difference of the amount of electrifications of the developer between colors is less than 8microC/g mutually. Moreover, a means to expose said each image support in order to form an electrostatic latent image consists of an exposure means by which the quantity of lights other than OFF can irradiate two or more light, in a basic image unit, and development is performed by impressing the potential or development bias of a latent charge image formed of two or more of these quantity of lights.

[0008] According to other modes of this invention, an electrostatic latent image is formed by performing electrification and exposure to two or more image support. By developing the electrostatic latent image formed in each image support with the developer of a different color for every image support, a visible image and nothing, For a means to be image formation equipment which imprints this visible image to record material, and obtains an image, and to expose said each image support in order to form an electrostatic latent image, it sets per basic image and the quantity of lights other than OFF are plurality (it is called below "two or more quantity of light level".). Consider as the exposure means which can irradiate light and it has the quantity of light selection means which enabled it to choose the specific quantity of light out of two or more quantity of light level prepared further beforehand. In the image formation equipment which was made to develop negatives with the development contrast defined beforehand and the quantity of light chosen by said quantity of light selection means by forming a latent charge image The amount of electrifications of each of said developer is 20-40microC/g in the development field which develops the electrostatic latent image of each of said image support, and the image formation equipment characterized by the difference of the amount of electrifications of the developer between colors being less than 8microC/g mutually is offered. Here, two or more numbers of quantity of light level chosen with said quantity of light selection means are almost equal in said each image support preferably, and image concentration (D) is made into 20% in 0.8<=D<=1.6 less than 14% in 0.6<=D<0.8 less than 10% in 0<=D<=0.6.

[0009]

[Embodiment of the Invention]

One or less example and one example of the image formation equipment concerning this invention are **(ed) on a drawing, and it explains in more detail.

[0010] Drawing 1 is the outline block diagram showing an example of the color electrophotography recording device which is the 1st example of this invention. In this example, 1st, 2nd, 3rd, and 4th image formation Wakebe Pa, Pb, Pc, and Pd is put side by side in the body of equipment of a color electrophotography recording device. Each image formation section is considered as the same configuration, and forms the visible image (toner image) of a respectively different color.

[0011] Furthermore, if it explains, the image formation sections Pa, Pb, Pc, and Pd possess the electrophotography photoconductor drums la, lb, lc, and ld by the image support of dedication, and this example, respectively. The image on the electrophotography photoconductor drums la, lb, and lc formed in each image formation sections Pa, Pb, Pc, and Pd and ld is imprinted on the record material 6 supported and conveyed on the record material support 8 which adjoins and moves to each image formation section. Furthermore, in the fixing section 7, it overheats and pressurizes, and is fixed to the image on the record material 6, and a record image is discharged to a tray 61.

[0012] Next, the latent-image formation section in each image formation section is explained. Electric discharge exposure lamp 2la, 2lb, 2lc, 2ld, and drum electrification machine 2a, 2b, 2c, 2d, the laser beam aligner 17 as an image exposure means, and the potential sensors 22a, 22b, 22c, and 22d are formed in the periphery of photoconductor drums la, lb, lc, and ld. It is uniformly charged by 2d and, subsequently, as for the photoconductor drums la, lb, lc, and ld discharged by electric discharge exposure lamp 2la, 2lb, 2lc, and 2ld, the electrostatic latent image according to a picture signal whose color was separated is formed on photoconductor drums la, lb, lc, and ld drum electrification machine 2a, 2b, 2c, and by being exposed by the laser beam aligner 17. As an image exposure means, the well-known multiple-value exposure means other than the above-mentioned laser beam aligner 17 can be suitably used for the image formation equipment of this invention in a basic image unit (pixel) like an LED array aligner in this so-called industry in which quantity of light level other than OFF can irradiate two or more light.

[0013] The electrostatic latent image on said photoconductor drum is developed with a development means, and let it be a visible image. That is, the developer of a cyanogen color, a Magenta color, a yellow color, and a black color, for example, 2 component developer with a toner and a carrier, is equipped with the development counters 3a, 3b,

3c, and 3d by which specified quantity restoration was carried out, respectively, and a development means develops the electrostatic latent image formed in the above-mentioned photoconductor drums la, lb, lc, and ld, and uses it as a visible image (toner image).

[0014] Next, the imprint section is explained. The record material 6 held in the record material cassette 60 is fed into the record material support 8 through the resist roller 13.

[0015] Here, the record material support 8 is a film made of dielectric resin, such as a polyethylene terephthalate resin film sheet (PET sheet), a polyvinylidene fluoride resin film sheet, or a polyurethane resin film sheet, the both ends are piled up mutually and it joins, and or it would not make it an endless configuration, the belt (seamless) which does not have a joint is used. It is desirable to constitute so that a means (not shown) to detect a joint location may be established in the case of the belt which has a joint and an imprint may not be performed on a joint.

[0016] If this record material support 8 begins to rotate, the record material 6 will be conveyed on the record material support 8 from the resist roller 13. At this time, an image beginning signal serves as ON, and a certain timing performs image formation on the 1st photoconductor drum la.

[0017] When imprint electrification machine 4a and imprint press member 41a are prepared, and uniform pushing force is given to the direction of a photoconductor drum in imprint press member 4la under the 1st photoconductor drum la and imprint electrification machine 4a gives electric field, toner **** on a photoconductor drum la is imprinted on the record material 6. At this time, the record material 6 is held by electrostatic adsorption power on the record material support 8, the record material 6 is conveyed to the 2nd image formation section Pb, and an imprint is performed. The record material 6 by which the toner image was hereafter imprinted by the 3rd and 4th image formation sections Pc and Pd by the same approach as the above is discharged with the separation electrification vessel 14, secedes from the record material support 8, and is conveyed by attenuation of electrostatic adsorption power to the fixing section 7.

[0018] The fixing section 7 consists of oil reservoir 78 for supplying the oil spreading roller 77 which applies to a fixing roller 71 release agent oil, such as the heat-resistant cleaning members 73 and 74 which clean a fixing roller 71, the pressurization roller 72, and rollers 71 and 72, respectively, the heaters 75 and 76 which heat each rollers 71 and 72, and dimethyl silicon, and its oil, and a thermistor 79 for fixing temperature control.

[0019] After an imprint, photoconductor drums la, lb, and lc and the developer which remained on ld are removed by the photo conductor cleaning sections 5a, 5b, 5c, and 5d, and the next latent-image formation performed succeedingly is equipped with it. Moreover, after the developer which remained on the record agent support 8 is discharged with the belt electric discharge vessel 12 and has electrostatic adsorption power removed, it is removed by cleaning equipment 62 equipped with the nonwoven fabric by this example. The fur brush which rotates as cleaning equipment 62, a blade, the equipment which used these together are used.

[0020] Next, the development means which can be adopted as the image formation equipment of this invention is explained in more detail with reference to drawing 2 . Since the development means in the image formation sections Pa, Pb, Pc, and Pd is considered as the same configuration, only the development means in the image formation section Pa is explained.

[0021] Drawing 2 is the abbreviation sectional view of the development means in the image formation section Pa. Development counter 3a which countered photoconductor drum 1a and has been arranged By the development sleeve 31 as the development container 30 and developer support which held 2 component developer, and this development sleeve 31 The blade 33 as the developer return member (developer ****** specification-part material on the development sleeve 31) 32 which regulates the developer conveyed from the supply location of a developer to an ear end location, and chain-like cluster height (thickness) specification-part material of a developer is provided. Furthermore, it has the optical developer concentration sensor (not shown) as a developer concentration detection means to detect the developer concentration (toner concentration) of 2 component developer.

[0022] The interior of the above-mentioned developer container 30 is divided by processing laboratory 30A and stirring room 30B by the septum 37 which extends perpendicularly mostly. 2 component developer containing a nonmagnetic toner and a magnetic carrier is held in processing laboratory 30A and stirring room 30B. The upper part section of a septum 37 is released and 2 component developers which became excessive by processing laboratory 30A are collected at the stirring room 30B side. Screw type 1st and 2nd developer stirring / conveyance means 34 and 35 are arranged at above-mentioned processing laboratory 30A and stirring room 30B, respectively. Stirring conveyance of the developer in processing laboratory 30A is carried out, and 2nd stirring / conveyance means 35 carries out stirring conveyance of the toner supplied to the upstream of this stirring / conveyance means 35 from a toner supply tub (not shown) under control of a developer concentration control unit, and the developer which is already in stirring room 30B, and 1st stirring / conveyance means 34 equalizes toner concentration. The

developer path (not shown) which makes processing laboratory 30A and churning room 30B open for free passage mutually in the edge a near side and by the side of the back is formed in the septum 37, and it is constituted so that the developer in processing laboratory 30A to which the toner was consumed by development and toner concentration fell by it may move into processing laboratory 30A from one path according to the conveyance force of the above-mentioned stirring / conveyance means.

[0023] The location equivalent to the development field which met photoconductor drum 3a is carrying out opening of the processing laboratory 30A of the above-mentioned development counter, and as it exposes to this opening in part, said development sleeve 31 is arranged pivotable. The development sleeve 31 consists of non-magnetic materials, it rotates in the direction of an arrow head at the time of drawing at the time of development actuation, and the magnet 36 which is a field generating means is being fixed to the interior.

[0024] Although 2 component developer supplied to the front face of the development sleeve 31 by the above-mentioned stirring / conveyance means is held in the state of a magnetic brush on the front face of the development sleeve 31 by the magnetism of a magnet 36 and is conveyed with rotation of the development sleeve 31 to photoconductor drum 1a and the development field which counters The ear end of the magnetic brush on the developer sleeve 31 is carried out by the developer return member 32 and the blade 33 on the way of [ conveyance ], and the developer conveyed to a development field is maintained by the proper amount.

[0025] Thus, the developer conveyed to the development field with the development sleeve 31 develops the electrostatic latent image which was supplied to photoconductor drum 3a and formed on it. The development bias which superimposed direct current voltage and an alternation electrical potential difference on the development sleeve 31 from the power source in order to raise the development effectiveness of toner grant, i.e., the rate to a latent image, According to or an operation of the direct-current electric field and the superposition electric field of an alternating electric field which one of development bias voltage was impressed and were formed in the development field of this Or the toner of 2 component developer shifts to the electrostatic latent-image side on photoconductor drum 1a, and an operation of one of electric fields develops this electrostatic latent image as a toner image.

[0026] The nonmagnetic toner used by this example was a toner of 5-11 micrometers of mean diameters which distributed the metal complex of an alkylation salicylic acid for the coloring content as a negative charge control agent further with 5 - 20 % of the weight, and it used titanium oxide (TiO2) for 80 - 90 % of the weight of polyester resin at this, having **(ed) it to it 0.2 - 2 % of the weight outside. In addition to this, a silica may be used for an external additive. Moreover, as for a magnetic carrier, the ferrite carrier, especially sintering ferrite particle of arbitration are used. That is, the carrier with a mean particle diameter of 30-60 micrometers which carried out the coat of the acrylic resin to this 0.5 to 2% of the weight for the purpose of frictional electrification nature, environmental stability, and the improvement in endurance was used, using Zn system ferrite, nickel system ferrite, Cu system ferrite, a Mn-Mg system ferrite, a Cu-Zn system ferrite, a nickel-Zn system ferrite, etc. as core material. If it considers as a coat agent, polyester system resin, fluororesin, silicon system resin, etc. can be chosen suitably, and can be used.

[0027] Drawing 3 is the V-D diagram showing the relation of the development contrast potential (fogging guarantee potential) (V) and development concentration (D) which are one of the development properties when having prepared yellow, a Magenta, cyanogen, and black as the above-mentioned toner, mixing the above-mentioned magnetic carrier to this, preparing 2 component developer, filling up a development counter, and developing negatives using development bias. Curve b shows the development property of a Magenta color developer over the development property a of an ideal. Furthermore, Curve c shows the development property of another Magenta color developer.

[0028] Although the main point of this invention is things making it all the color developers held in each development counter to be used be a near an ideal property, in order to give explanation intelligible, the same Magenta color explains using that from which the development property of a developer differs. It is as follows when the developer conditions from which the development property b was acquired are arranged.

[0029] **** was made into 1.0 % of the weight outside titanium oxide using what mixed 18.5 % of the weight (C. I Pigment Red 6) of Magenta pigments, and a negative charge control agent 0.5% of the weight at the 90 % of the weight base of polyester resin. What had two kinds of amounts of coats of 0.5 % of the weight and 2.5 % of the weight for acrylic resin in the sintering ferrite particle as a carrier was prepared.

[0030] Thus, the prepared developer was used for the above-mentioned development counter, and image formation was performed on condition that the following. the passing speed on the front face of a photoconductor drum (****) -- 135 mm/sec and development -- a reversal development method -- using -- photoconductor drum potential -- dark

potential Vd= -500 (v) and light potential Vl= -- DC component Vdc= of -100 (v) and development bias -- it was referred to as -400 (V). In a reversal development method, development contrast is defined as follows. Namely, = (development contrast) (light potential) - (development bias DC)
It comes out. Moreover, the fogging potential shown in drawing 3 is = (fogging potential) (dark potential). - (development bias DC)
It comes out.
[0031] Development contrast is set to 300 (V) by this example.
[0032] AC component of bias is [ the frequency 12 (kHz) of AC part and the repeat frequency of 2 cycle of Vpp=2 (kV) and a frequency ] 1.5 (kHz) using a wave as shows development bias to drawing 4 .
[0033] A development sleeve peripheral surface rate is 1.7 times the photoconductor drum peripheral surface rate, and he is trying to rotate the conditions of a developer in the same direction as a photoconductor drum in a development field, as shown in drawing 2 . Moreover, the amount in the development field of the developer mentioned above is 40 mg/cm2. The developer return member 32 and blades 33 were adjusted so that it might become.
[0034] Now, although the above-mentioned development property (development contrast pair image concentration) b prepared what had two kinds of amounts of coats of 0.5 % of the weight and 2.5 % of the weight for acrylic resin in the sintering ferrite particle as a carrier, it was the case where the amount of acrylic resin coats of these was 2.5 % of the weight. On the other hand, the development property c was that whose amount of acrylic resin coats is 0.5 % of the weight.
[0035] When studied about what the difference of such a development property is, it turned out that it originates in a big difference being in the amount of average electrifications of the developer in a development field (henceforth "average TORIBO"). Said average TORIBO of the developer with which said average TORIBO of the developer which shows the development property b shows 30microC/g and the development property c was 20microC/g.
[0036] This average TORIBO was measured by the blow mesh technique. Next, a blow mesh technique is explained.
[0037] The container of the configuration of drawing 5 is connected with the grounded sheathing container 101 at an electrometer 102, and it consists of a contents machine 103 with which the outer container 101 was insulated, and does not let the particle of a carrier grain size pass in the contents machine 103 further, but the mesh 104 chosen so that the particle of a toner grain size might be passed is arranged. A developer is supplied in the contents machine 103. Moreover, the contents machine 103 is connected to the aspirator. In order to ask for average TORIBO, the developer which had weight measured beforehand is supplied to the contents machine 103, and the amount of charges at this time is measured by the electrometer. The measured amount of charges is set to c1, and weight is set to m1. Next, only a toner is attracted with an aspirator and the amount of charges at this time is too measured by the electrometer. The amount of charges at this time is set to c2. Then, it asks by the following count, measuring the weight of the remaining carrier and using this as m2.
(Average TORIBO) =(c1-c2)/(m1-m2)
[0038] Although it was near all over [ a ] drawing as a development property and the direction suggested the good thing here, in a property b, **** is not necessarily actually in practical use. Hereafter, it explains how it is appropriate that this judgment is made. The picture signal processing circuit which obtains the gradation image which is adapted for this example beforehand for this explanation is explained.
[0039] In drawing 6 , the light figure of a manuscript is irradiated by the CCD component 202, and is changed into a luminance signal by the joint lens 201 with this CCD component 202. A luminance signal is changed into a digital luminance signal in an A/D-conversion circuit. The digital signal of A/D conversion used general-purpose is 8 bits (256 level), and the luminance signal of the read manuscript is changed into the digital signal of 256 level.
[0040] As for the acquired luminance signal, the sensibility variation of each CCD component 202 is corrected by the shading circuit 204. Brightness is changed into concentration using concentration being in LOG (luminance signal) and proportionality. That is, the corrected luminance signal is changed into a concentration signal through a LOG conversion circuit. A concentration signal exposes photoconductor drums 1a, 1b, 1c, and 1d with the aligner 17 which accompanies each image support, after color processing is carried out after this in masking and the UCR (lower color processing) circuit (henceforth an "image-processing circuit") 205.
[0041] The aligner 17 is equipped with the circuit which can carry out decomposition exposure by making into the quantity of light or lighting time amount the 8 bits (256 level) image concentration signal mentioned above, using semiconductor laser as an exposure means. As mentioned above, as an aligner 17, it is not limited to this, and quantity of light level other than OFF can use the multiple-value exposure means of the arbitration which can

irradiate two or more light in a basic image unit.
[0042] Here, a look-up table (henceforth "LUT") 206 is explained for starting this invention. LUT206 is prepared in order to reproduce the concentration signal of the image mentioned above in a form faithful to concentration by the image support section. LUT is created using the development property b acquired previously, and this is explained.
[0043] LUT206 constitutes the quantity of light selection means which enabled it to choose the specific quantity of light out of the quantity of light level prepared beforehand, and has the function to change the concentration signal X level (either of zero to 256 level) from the image-processing circuit 205 into another level Y. For example, if the development property b previously shown in drawing 3 when it sets up so that it may output on the same level as an input signal is rewritten to input signal pair image concentration, it will become as shown in drawing 7 (A) and (B), and it will become a reappearance image concentration input signal (it is proportional to concentration). That is, the inside of drawing and an input signal X0 Y0 It becomes. If a development property is a, it will be understood that this LUT is unnecessary.
[0044] Then, in order to carry out the property of a reappearance image like [ in the case of the development property a ] in the case of the development property b, as shown in drawing 7 (A), the maximum of concentration expressed to the axis of ordinate is standardized on 256 level noting that it is decomposed into 8 bits (256 level) from the first. Thus, the property hb which moved the made relation of output image level by which input-level pair standardization was carried out to the symmetry to the straight line k in drawing is prepared. This property hb is put in into LUT, as shown in the 4th quadrant of drawing 7 (B) and a (sensitometry), and an input signal is related to a property hb, and is outputted and developed. At drawing 7 (B), it is an input signal X0. Becoming an output signal Y1, i.e., the concentration of the reappearance image shown in the 2nd quadrant of drawing 7 (B) becoming a thing based on the development property a, will be understood.
[0045] By the way, although it seems to reproduce the signal from an image-processing circuit faithfully about concentration when LUT is used in this way, cautions are required further in practice and this part serves as an important section of this invention. LUT is created and explained like the case of the development property b which mentioned this above using the development property c.
[0046] Since the maximum concentration of development was adjusted by development contrast, development contrast was set to 250 (V) so that drawing 3 might also show. It turns out that the picture signal which is proportional to concentration from an image-processing circuit also in this case is reproduced faithfully so that it may understand also with the sensitometry of drawing 8 (B).
[0047] However, if the above-mentioned image formation equipment with which a development property prepares the toner of another color at c, for example, cyanogen, and develops this and with which it can be adapted for this invention actually performs image formation, a jump of a color will occur in the blue which is the mixed color of a Magenta and cyanogen. This is based on lack of the signal in LUT.
[0048] When the lack ratio of the signal from an image-processing circuit was investigated in the property hc of drawing 8 , and the property hb of drawing 7 , a certain thing actually became clear 30% or more of the signal of 256. if this is investigated more in a detail -- the concentration gradation in viewing of people -- it became clear that the ratio which is not known even if there is relation of resolution and a lack ratio changes with concentration fields existed.
[0049] When lack of the signal in LUT between different colors set image concentration to (D) as extent which does not eye sudden have people, it carried out ** distinct [ of being 20% ] in 0.8<=D<=1.6 less than 14% in 0.6< D<0.8 less than 10% in 0.0<=D<=0.6. Furthermore, when written in addition, as extent in which lack of the signal in LUT in monochrome level does not eye sudden have people, it is generous from the amount of lack between colors, and it turned out in the range of 0.0 <=DD0.6 that it is about 30% in 0.8<=D<=1.6 less than 20% in 0.6< D<0.8 less than 15%.
[0050] Thus, with the image formation equipment which has two or more image support, it turned out that the design which took into consideration the amount of signal lack between colors in LUT used in order to guarantee concentration gradation nature in each image support is required.
[0051] Then, if it carries out what in case image formation equipment is actually designed, the point whether this condition can be satisfied will be explained.
[0052] Although explained using the developer of the same color (Magenta) above, in order to use four colors of a yellow, a Magenta, cyanogen, and black as a color, in the image formation equipment which has for this two or more image support which can be adapted for this invention, mutual relation must be determined more strictly.
[0053] From the first, the purpose of using LUT needs to observe a development property, in order to dedicate the lack ratio of the signal in said LUT within fixed limits, since it is an amendment means for the ability not to attain

the ideal development property a in development. It is as having mentioned above that the maximum concentration of development can be freely chosen by development contrast setup of each image support. Moreover, the difference in a development property already explained that it was also mainly related to average TORIBO of the developer in a development field. Furthermore, when the conditions which a gradation jump does not generate in concentration gradation reappearance in spite of lack of the signal in the above-mentioned LUT were looked for about this average TORIBO, it turned out that there is the following relation.

[0054] That is, the difference of average TORIBO of a developer of the conditions which a gradation jump does not generate is 20-45microC/g in the developer in a development field, and it turned out that average TORIBO of the developer between colors is less than 8microC/g mutually. I hear that the greatest average TORIBO in the developer of other colors at that time is less than 28microC/g, and this has it, when average TORIBO of the developer of a certain color is 20microC/g. The maximum of average TORIBO is specified as range where for example, the multiplex imprint which is constraint of others of this invention is carried out to stability.

[0055]

[Effect of the Invention] As explained above, the image formation equipment of this invention In the image formation equipment which imprints a visible image, and nothing and this visible image to record material with the developer of a color which is different for every image support in the electrostatic latent image which formed the electrostatic latent image in two or more image support, and was formed in each image support, and obtains an image The concentration tone reproduction on which the amount of electrifications of each of said developer which develops the electrostatic latent image of each of said image support spreads abbreviation etc. and which does not have a gradation jump since it is carried out is good, namely, the good image which does not have the color nonuniformity in the case of obtaining an image in piles in the color more than a two color can be obtained.

[0056] Moreover, a means to expose said each image support so that especially the image formation equipment of this invention may form an electrostatic latent image In a basic image unit, consider as an exposure means by which quantity of light level other than OFF can irradiate two or more light, and it has the quantity of light selection means which enabled it to choose the specific quantity of light out of the quantity of light level prepared further beforehand. It is made to develop negatives by forming a latent charge image with the development contrast defined beforehand and the quantity of light chosen by said quantity of light selection means. Further the amount of electrifications of each of said developer Are 20-40microC/g in the development field which develops the electrostatic latent image of each of said image support, and the difference of the amount of electrifications of the developer between colors by constituting so that it may become less than 8microC/g mutually The good image which whose concentration tone reproduction without a gradation jump is good, namely, does not have the color nonuniformity in the case of obtaining an image in piles in the color more than a two color can be obtained.

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[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing one example of the image formation equipment of this invention.
[Drawing 2] It is the sectional view of one example of the development means in the image formation equipment of drawing 1 .
[Drawing 3] It is drawing showing the development property of a developer that average TORIBO differs.
[Drawing 4] Development bias is drawing showing a system.
[Drawing 5] It is the explanatory view of the measuring device of average TORIBO.
[Drawing 6] It is the block diagram showing the picture signal processing from CCD.
[Drawing 7] An example explaining the image formation working principle which used LUT with the image formation equipment of this invention of a sensitometry is shown.
[Drawing 8] Other examples of the sensitometry explaining the image formation working principle which used LUT with the image formation equipment of this invention are shown.
[Description of Notations]
1a-1d Image support (photoconductor drum)
2a-2d Electrification means
3a-3d Development means
4a-4d Imprint electrification machine
6 [ ] Record Material
17 [ ] Exposure Means

[Translation done.]

* NOTICES *



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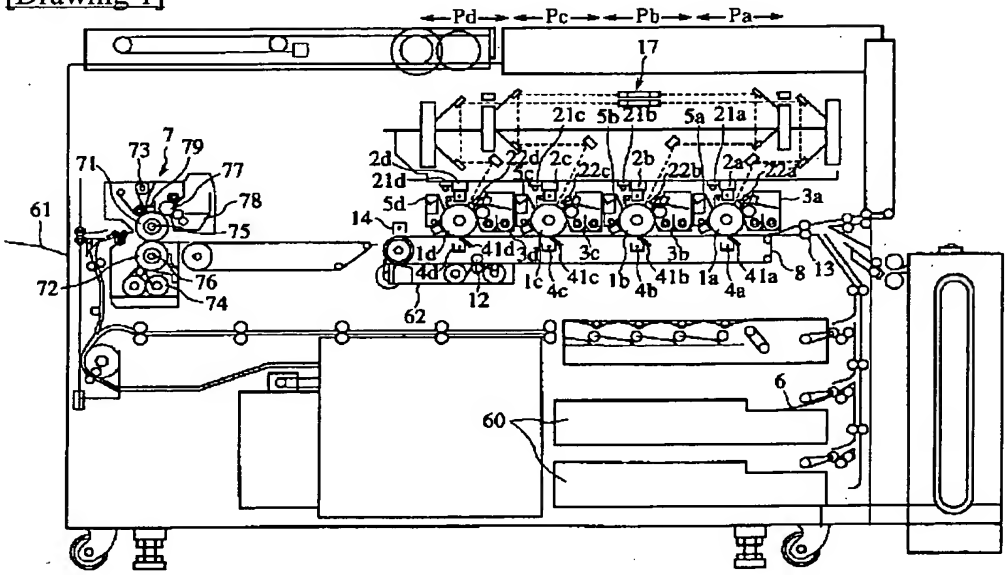
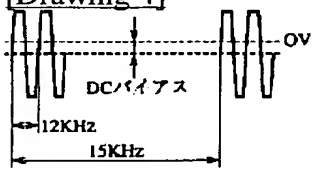
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

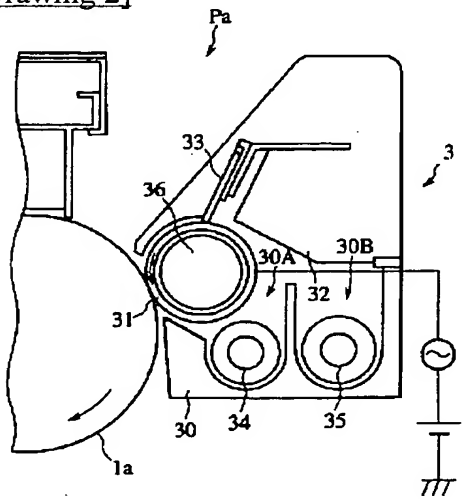
[Drawing 1]



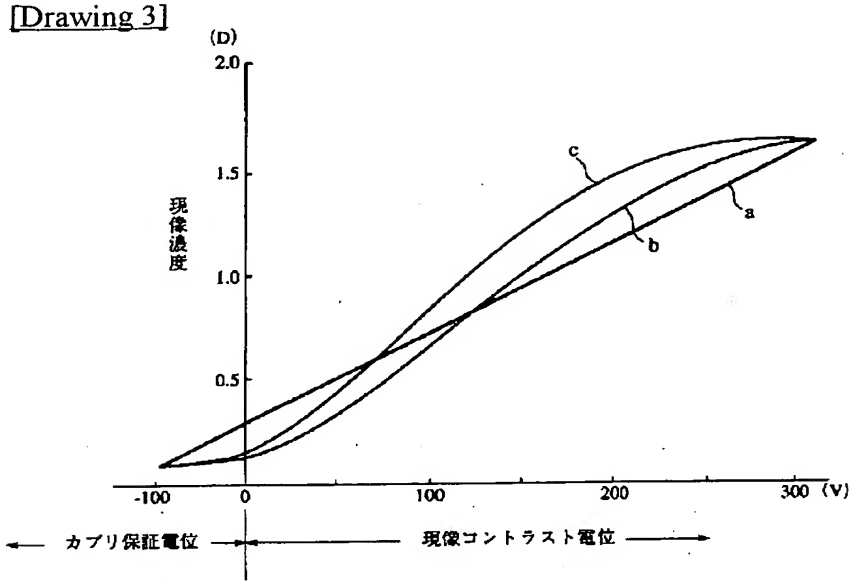

[Drawing 4]



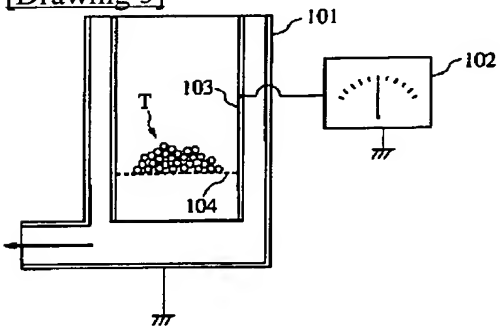

[Drawing 2]



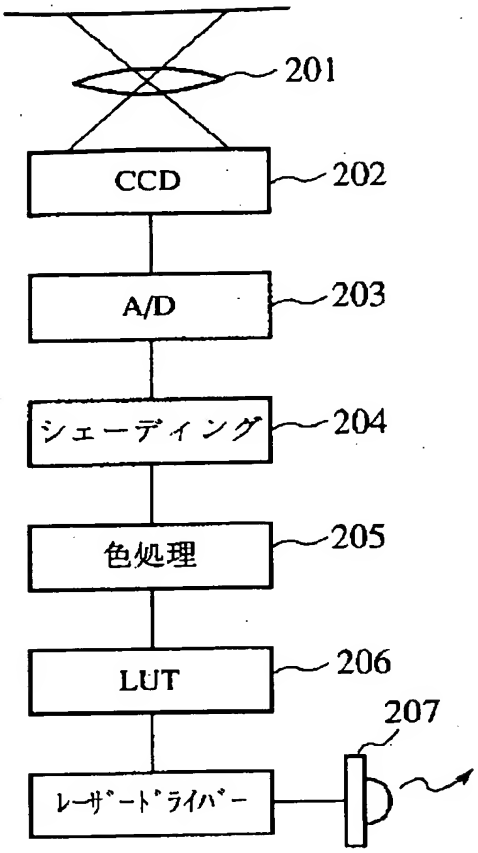
[Drawing 3]



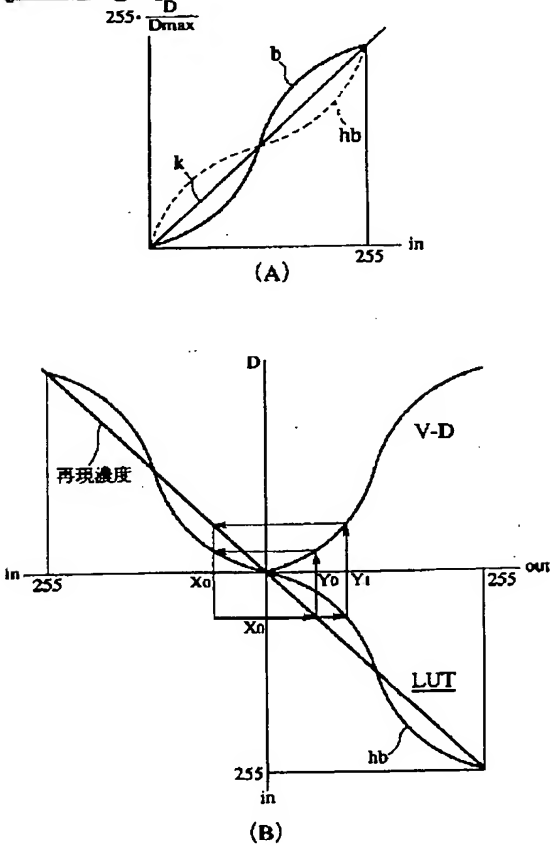

[Drawing 5]



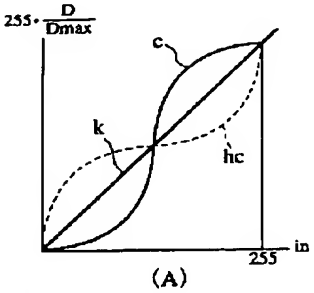

[Drawing 6]



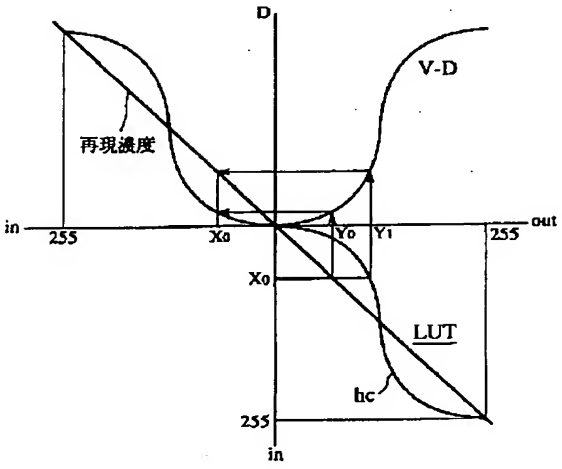

[Drawing 7]




[Drawing 8]




(A)




(B)

[Translation done.]